Fifth Annual Conference on Carbon Capture & Sequestration

Steps Toward Deployment

Geologic – Monitoring Mitigation, and Verification (Field)

Design and Deployment of Integrated Instrumentation System in a Monitoring Well at the Penn West Pilot, Alberta, Canada

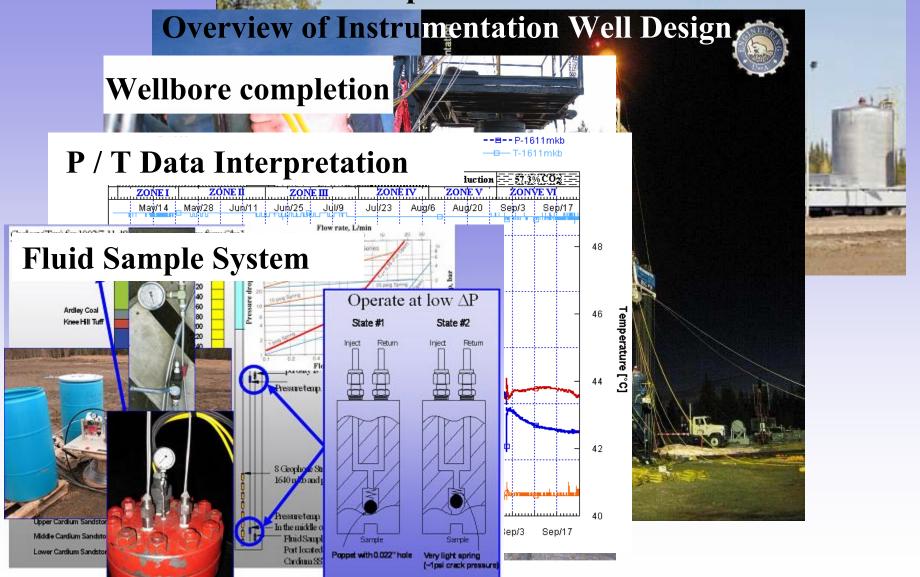
Dr. Rick Chalaturnyk, Gonzalo Zambrano

University of Alberta, Edmonton, Alberta, Canada

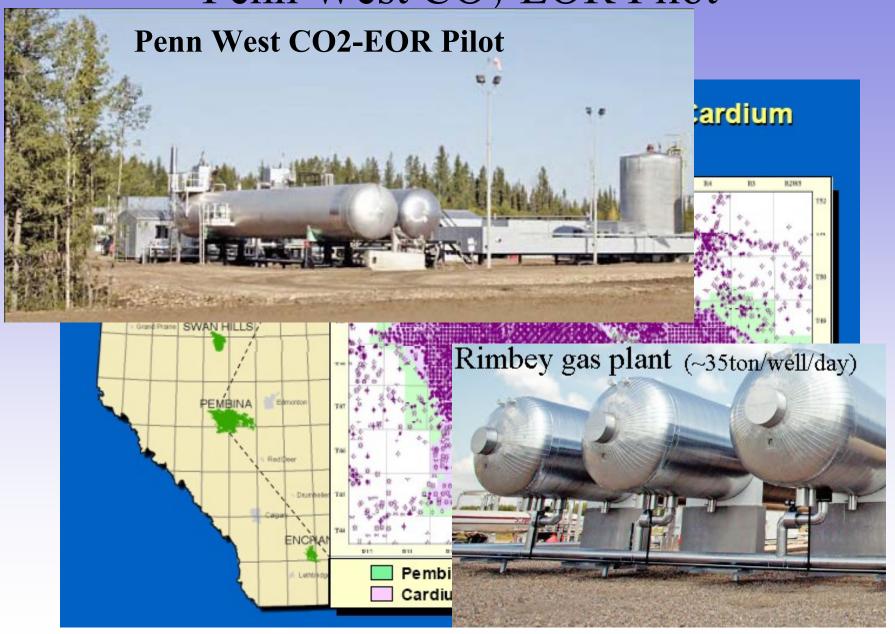
May 8-11, 2006 • Hilton Alexandria Mark Center • Alexandria, Virginia

Outline of Presentation

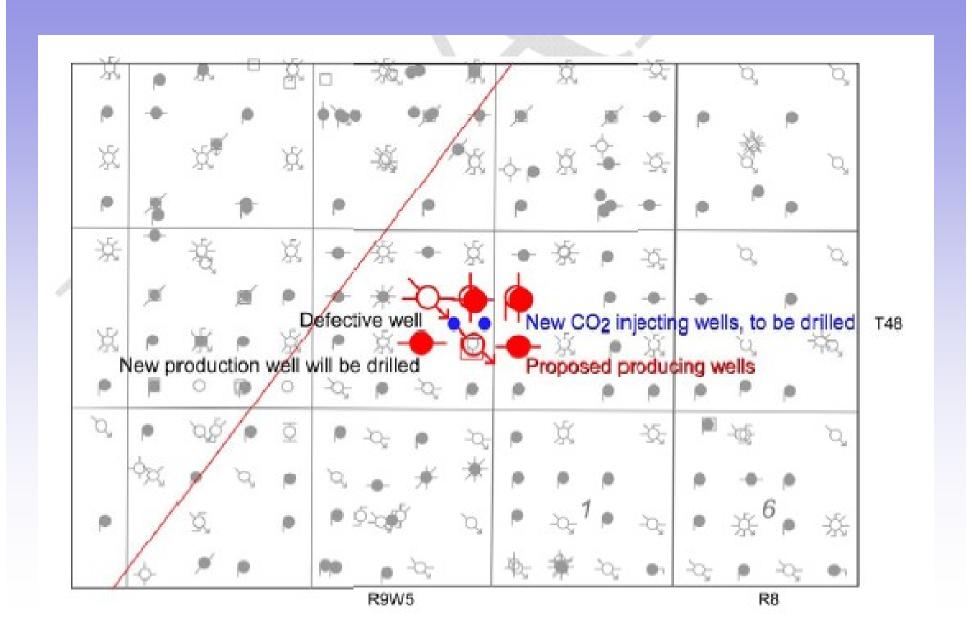
Brief Description of Penn West CO2-EOR Pilot



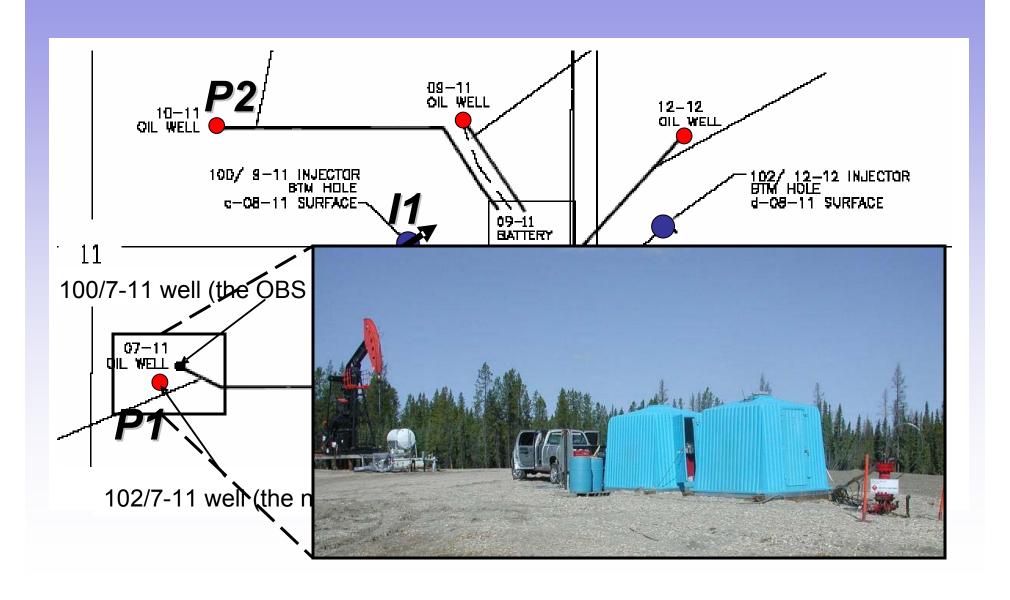
Penn West CO₂-EOR Pilot



Pennwest CO₂-EOR Pilot



Pennwest CO2-EOR Pilot 6 Producers, and 2 injectors



Observation Well Specifications

• Well depth: 1600 m (5250 ft)

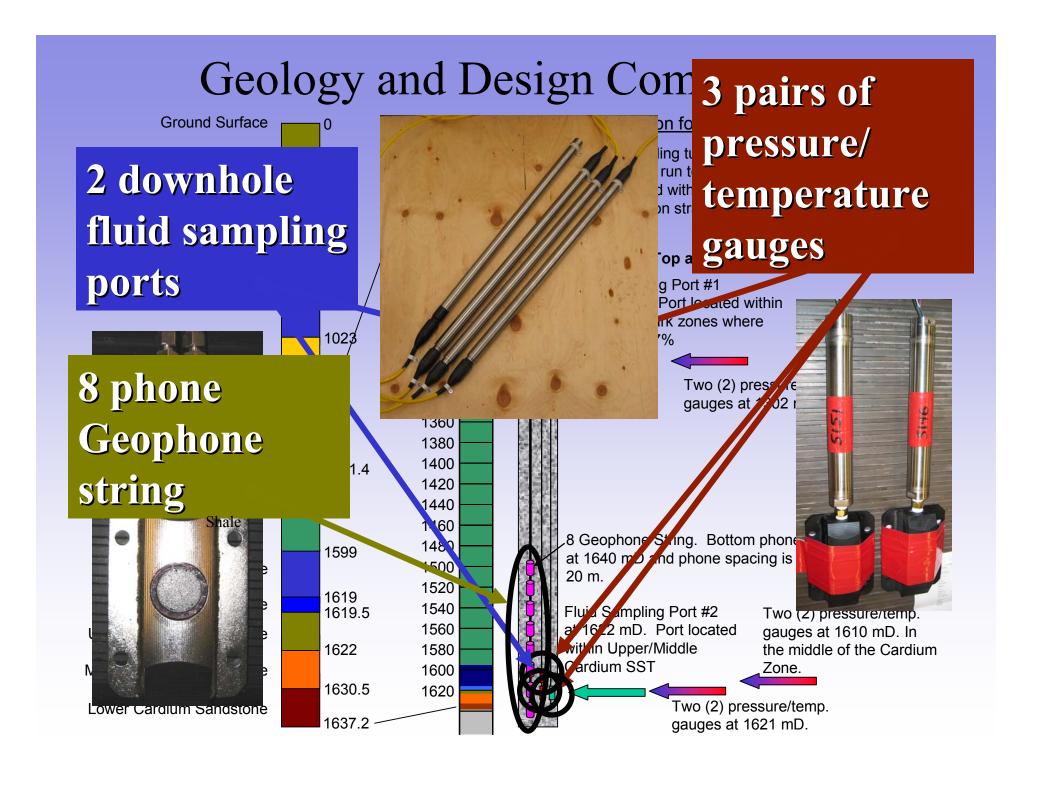
• Casing: 139.7 mm (5.5 in) @ 25.3 kg/m

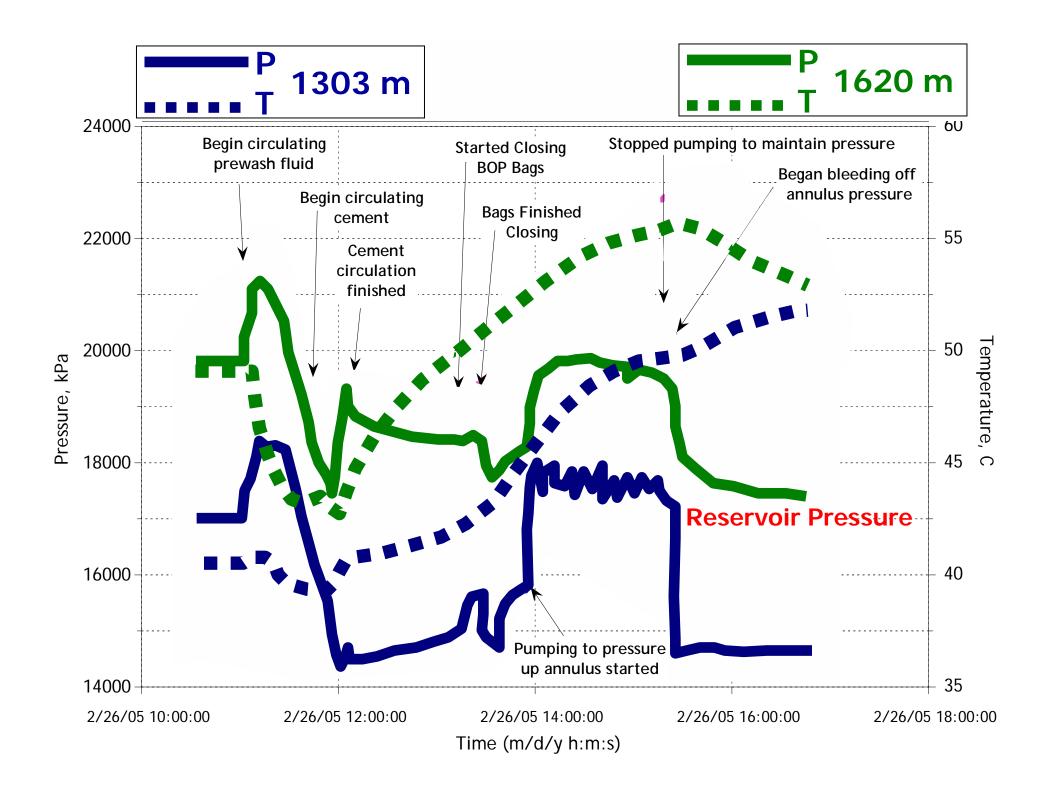
• BHP: approximately 19 MPa (2700 psi)

• BHT: approximately 50°C (122 °F)

• Deviation: none (vertical well)

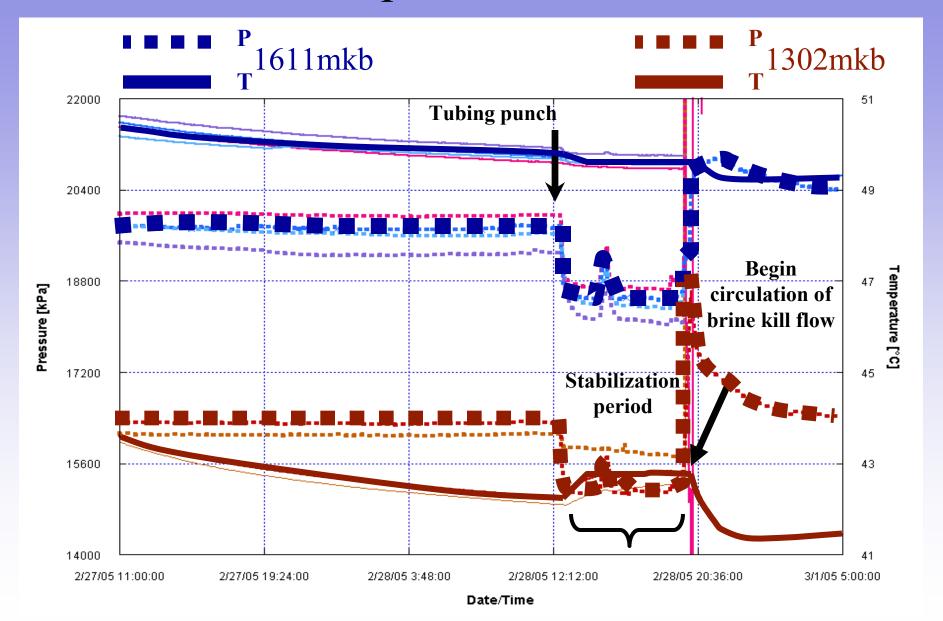
• Other: well is sweet



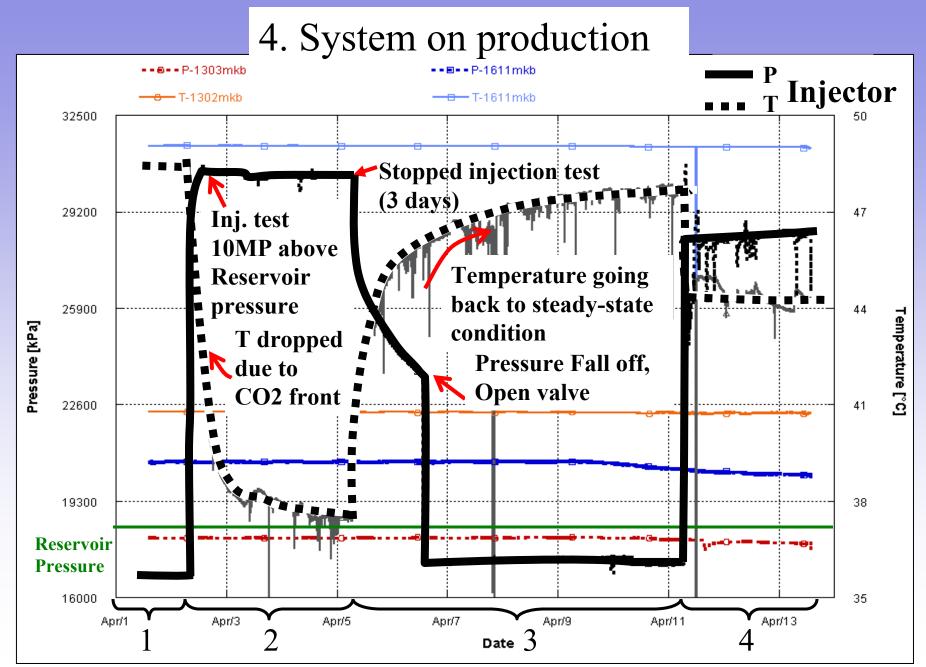


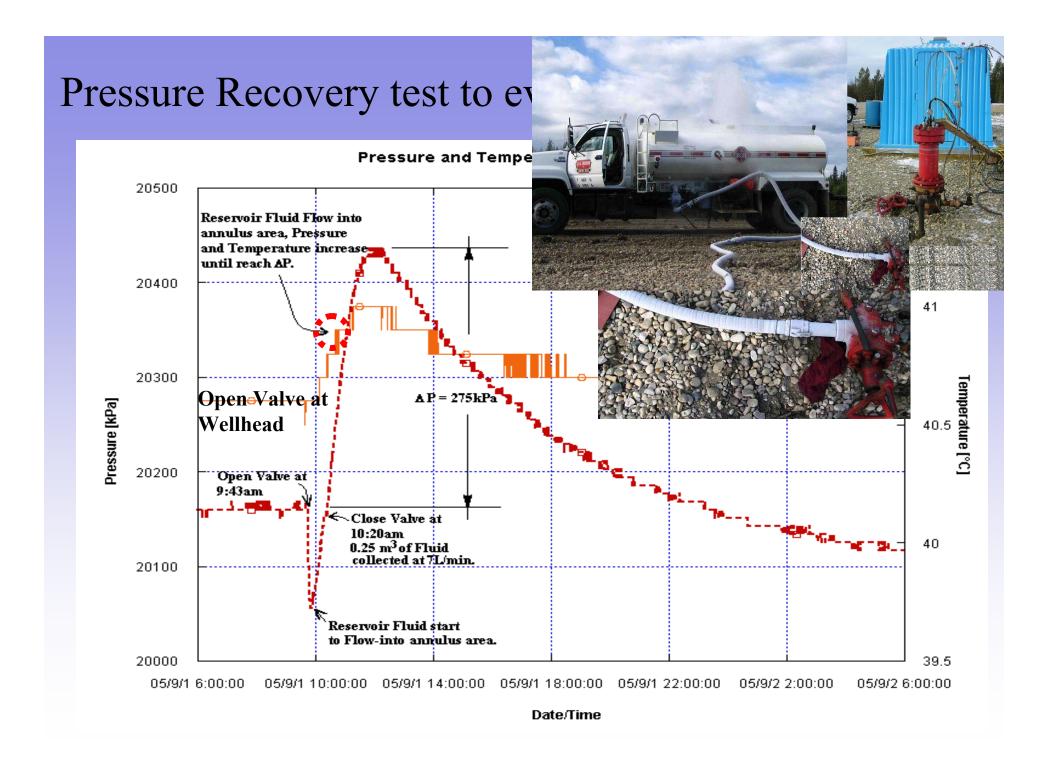


Wellbore Completion Feb 27 to Mar 1

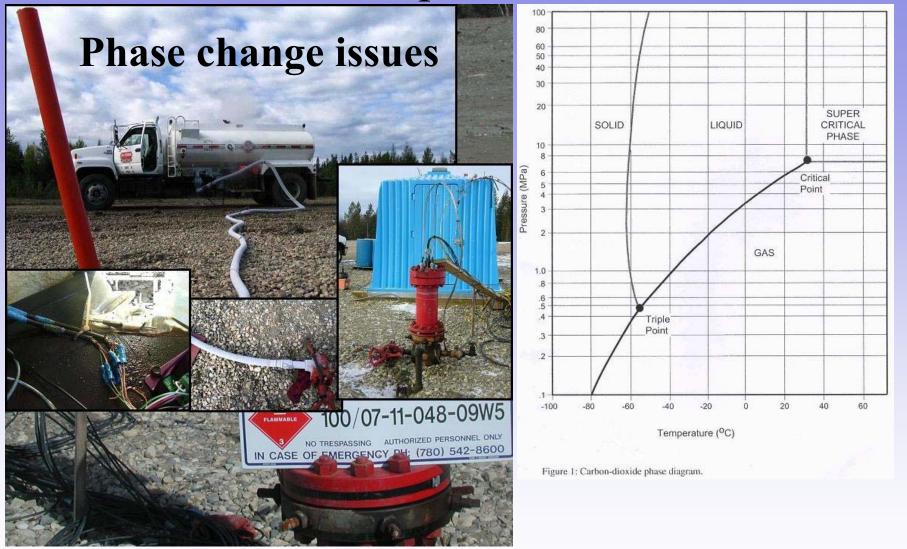


Early PT reading in Observation and Injection Wells

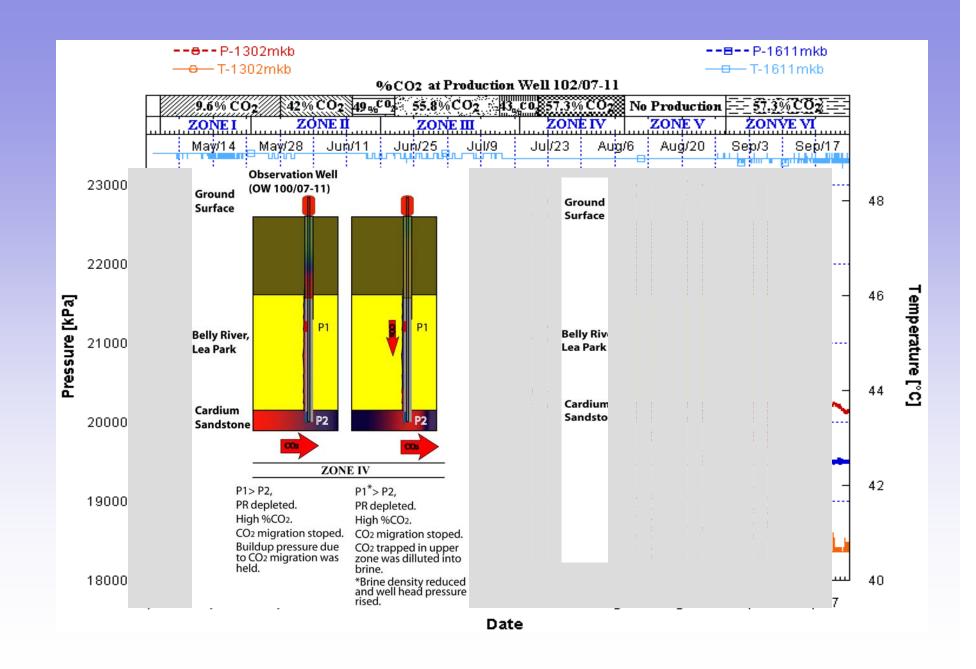




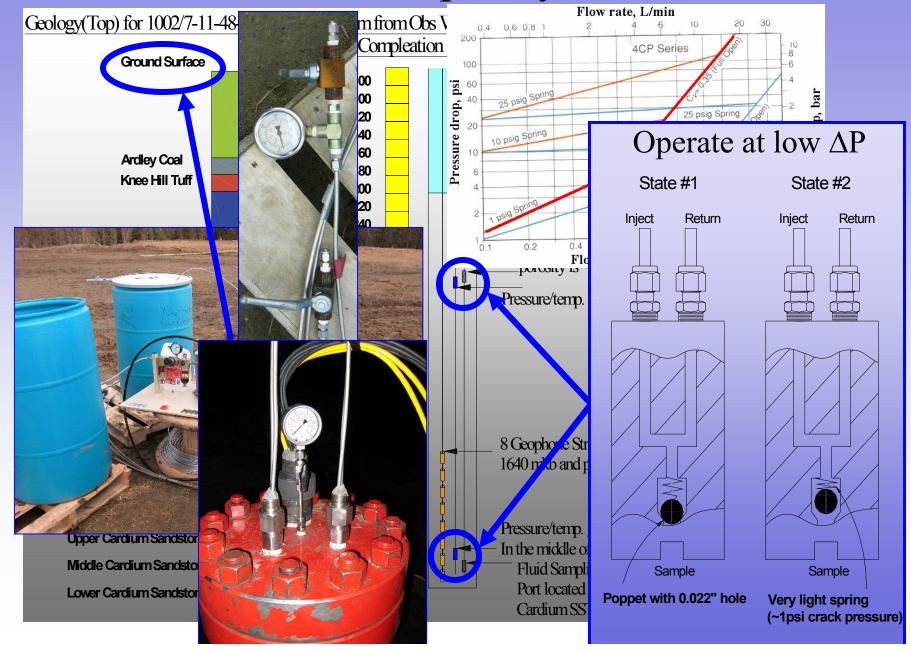
Pressure and Temperature Assessment



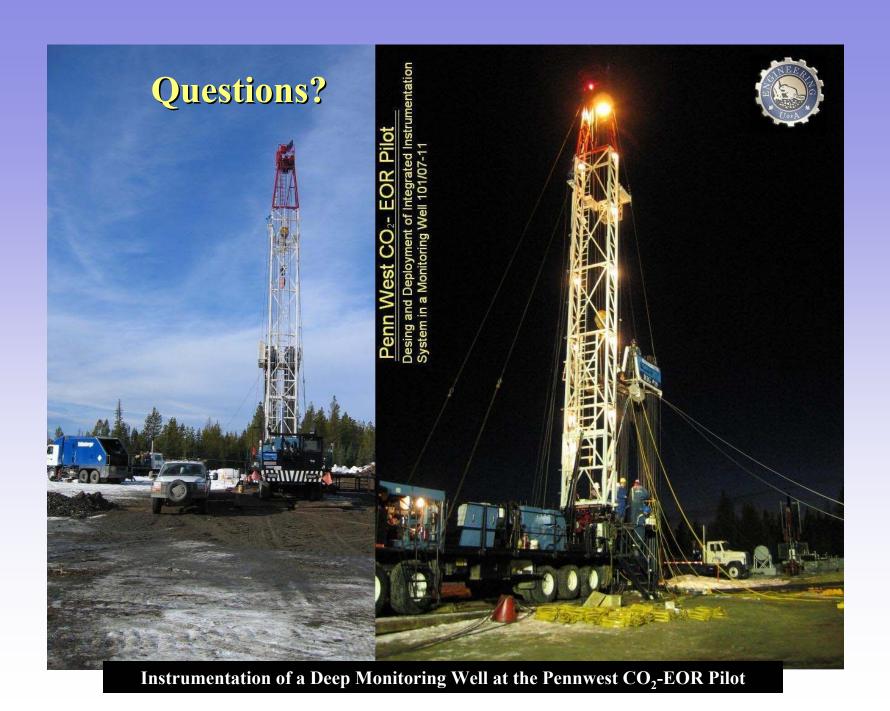
Leakage enhanced by CO2 buoyancy.



Fluid Sample System







CO2-EOR Pilot Conditions

- Previous reservoir history included primary and waterflooding (injected water was fresh)
- Inject food grade CO_2 (~ 35t/well/day) from Rimbey gas plant through two new directional wells drilled from the same pad. Some recycling of CO_2 . No water-alternating-gas injection.
- Pilot length is two years of injection plus and additional 1 to 3 years of production.
- 20 acre spacing, two injectors and 6 producers.
- Access is excellent (1 hr Edmonton, 3 hrs Calgary).
- Perforations concentrated in upper and middle sand. 50 tonne fracs in all 8 wells, in some cases they are refracs. They connect all three sands. Expect production from all three sands but dominantly from upper two sands due to perforations placement and permeability distribution.

CO2-EOR Pilot Conditions

- Downhole pressure/temperature gages on the injection wells
- The oil does not contain CO2, so the injected gas will be traceable.
- Extensive fluid monitoring from all production wells (primarily to monitor issues with scaling, corrosion and paraffin) and geochemistry monitoring program.
- Geophysical logs of standard suites will be made available. They will consider sharing costs of cased hole neutron, dipole sonic and FMI.
- Penn West has 100% interest on the lease.
- Huge potential for expansion to the entire Pembina Cardium field, the largest oil field in N. America, with 8000 wells to date, where Penn West is a partner in 65% of the field, and operates ~35%.
- 100 Km from Red Deer, Fort Saskatchewan and Wabamun, three of Alberta's 4 CO₂ hubs.